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Testimony before the U.S. Senate Committee on Commerce, Science, and Transportation

"The International Space Station: A Platform for Research, Collaboration, and Discovery"

July 25, 2012

Introduction

Good morning. It's a privilege to be here before you this morning and I want to thank the Committee for this opportunity to update the American people about the performance and accomplishments of the Center for the Advancement of Science in Space, better known as CASIS, and its role as the manager of the International Space Station National Laboratory (ISS NL).

The entire CASIS organization is working diligently to establish procedures for outreach, business development, operations, education and fundraising that will ensure we successfully enable companies, academic researchers, students and federal agencies to conduct research and development on board Station. These efforts will produce breakthroughs in science, technology, materials and pharmaceutical drugs which will provide American taxpayers with a positive return on their investment while benefitting all humanity.

Because of its unique mission and mandate, CASIS has greater flexibility and can conduct activities far different than NASA. As Congress intended, CASIS' status as an independent and non-profit organization allows for the development of partnerships, funding sources, endorsements, and other opportunities that NASA cannot pursue. CASIS can raise money, advertise, and innovate in ways that open new opportunities for ISS utilization.

The CASIS staff shares the Committee's sense of urgency with regards to maximizing use of the ISS NL. In the following testimony, I will discuss how CASIS is developing and pursuing innovative, forward-leaning, and broad strategies to attract a wide-range of users to ISS NL.

Foundation and organizational structure

During its standup phase, CASIS has developed an organizational structure faithful to our proposal, Cooperative Agreement with NASA, and original Reference Model, but one which is also responsive to the practicalities of implementation and the realities of the marketplace.

We currently have 27 full-time employees. Staff members bring with them an array of skills and extensive experience with NASA and the aerospace industry, R&D, venture capital, media, commercialization, management, and operations. Our staff has worked with urgency to establish CASIS' essential functions: business development, marketing, education, and operations. We have worked and partnered with industry, academia and others to ensure that the CASIS organization can be responsive to the needs of potential users of the ISS NL. We have conducted extensive outreach activities. All work undertaken thus far has been in an effort to move the organization forward in an efficient, timely and practical manner in step with efforts to establish

a permanent Board of Directors and executive leadership. We are confident that the steps taken so far to identify initial research pathways while raising awareness and developing partnerships satisfy our mandate and will be approved by a permanent Board of Directors.

The Board of Directors selection process began several months ago when the Interim Board contracted with a well-respected executive search firm, Korn/Ferry International, to conduct an independent, verifiable search for qualified candidates. Stakeholders, including the leadership of this Committee and its House counterpart, NASA, and other science-focused federal agencies, had the opportunity to submit names of Board candidates. Through a series of evaluations, interviews, and down-selects, the Interim Board has identified the first group of permanent Board of Directors candidates, all of whom represent the best American minds in the fields of scientific research and management from academia, government, and industry. An announcement of the first set of Board members will be made shortly, with the remaining 15-member Board finalized soon thereafter. As envisioned by Congress and the ISS NL Reference Model, the permanent Board will be made up of world-class scientists and leaders who will provide CASIS with guidance, expertise, and credibility. They will serve as ambassadors for CASIS and the ISS NL, reaching new users and supporters through their various networks. Additionally, the initial permanent Board members will appoint the permanent Executive Director.

While awaiting the appointment of a permanent board, CASIS has taken steps to establish a path toward effective utilization in line with Congressional intent, our Cooperative Agreement with NASA, and other guiding documents. This includes the appointment early this year of a world-class Interim Chief Scientist and an Interim Science Collegium comprised of renowned experts to review past life sciences research conducted in space in order to identify initial research pathways. Their effort resulted in our first solicitation for research in the area of protein crystallization. This is a well-established area of interest for researchers, but in need of a more systematic approach than has been taken in the past. The validity of the collegium's approach is supported by a recent National Academy of Sciences' study highlighting the importance of studying crystal growth without gravitational bias. Protein crystallization in microgravity can validate its scientific worth and unlock the potential for countless discoveries.

State of Valuation and Prioritization Process

CASIS' valuation model has been developed in order to best respond to the specific needs of the ISS NL as well as to meet the requirements of our charter. Designed to be a transparent process, it incorporates standard business model elements with regards to project evaluation and prioritization and has evolved into a robust methodology, taking into account scientific merit, economic value, readiness, and operational feasibility.

An interim process was used on multiple test cases, starting with an operational review to gauge the feasibility of proposals. The Interim Chief Scientist and his team reviewed projects for scientific merit and impact. The Chief Economist and his team then assessed projects for value and potential return to the U.S. taxpayer. Our compliance team scrutinized the legal implications and challenges. Final decisions were made by the Interim Executive Director with Interim Board approval.

Once a permanent Board of Directors is in place and selects a permanent Executive Director, the final CASIS Evaluation and Prioritization Framework will be used on solicited and unsolicited proposals. Under the final methodology, the interim process expands to include the evaluation of projects by the scientific collegium and outside industry experts who will score and help prioritize projects using a standardized set of metrics for the scientific and economic reviews. These metrics will be posted publicly on the CASIS website. Taking into account the scoring results, the CASIS science and economic teams will deliver the final recommendations to the Executive Director, Chief Scientist and Chief Economist, who will then make the final award and funding decisions. The methodology is designed to adapt to new and ever-changing market demands. The Framework in its entirety is spelled out in Appendix iii.

Outreach Efforts

The vast majority of Americans, including business leaders and leading scientific researchers, simply do not know that the ISS NL exists and is open to them for research. To fully realize the potential of the ISS NL, there must be aggressive outreach and education activities to raise awareness of Station and its capabilities. This has become a top priority for CASIS. Over the last 11 months, we have set out to establish and develop relationships with new and previous researchers, commercial entities, entrepreneurs, financial partners, philanthropic organizations, educators, students, and citizen scientists. Since March, CASIS staff has met representatives from over 165 organizations from coast to coast to inform them about the numerous opportunities to use the ISS NL.

In addition, CASIS has supported the *Destination Station* outreach programs by participating with NASA on several research panels, Twitter Town Halls, University presentations, and informational exhibit booths.

Last month, CASIS, in conjunction with the American Astronautical Society (AAS), was a co-sponsor and active participant in the First Annual ISS Research and Development Conference conducted in Denver, CO. During this conference, CASIS also successfully produced and coordinated the first-ever Implementation Partner Tradeshow, which included over 20 implementation partners exhibiting their capabilities. This provided a cutting-edge venue for the over 400 attendees, who could be potential users of the ISS National Lab, to collaborate with established payload implementation and integration partners, allowing them the opportunity to gain an understanding of the capabilities available to ensure the success of science missions.

Over the last six months, CASIS has reached out to hardware providers, flight and integration specialists and others to create a consolidated directory of implementation partners to assist ISS NL users to efficiently and effectively get their research into space. The ever-expanding resource is the first of its kind and is available in hard copy or as a PDF via the CASIS website. It provides technical and contact information useful for ISS NL users and currently lists more than 35 specialized companies and organizations The objective is to match users with integration and hardware partners and in doing so stimulate new investigators and researchers by making it easier and more cost-effective for to prepare their research for flight.

In June, CASIS announced the creation of the “Space Is In It” seal which the organization will bestow upon companies that successfully develop commercial products based on research and

development, testing or use on the ISS NL. Through the "Space Is In It" endorsement, CASIS positions Station in the forefront of the general public's understanding of our space program. This seal adds marketing value to the ISS and allows non-traditional users the opportunity to understand the benefits of science in space. The goal of the seal is to connect Station and the ISS NL research with consumers, fix ISS awareness more strongly in people's minds and in pop culture, and to entice U.S. companies to look more carefully at the value of developing and researching products on Station. Last month, CASIS announced it would award the "Space Is In It" seal to any products developed by COBRA PUMA Golf from investigations on the ISS NL, after the golf manufacturer declared its intention to conduct materials research on Station with the hopes of creating revolutionary sporting goods for consumers.

Education Initiatives

While the overlying mission of CASIS is to effectively and fully utilize the ISS, educating the future engineers and technical professionals of tomorrow about Station and careers in space are paramount to maximizing our nation's investment. The CASIS Education Program seeks to use the research CASIS brokers on Station as a springboard to increase STEM literacy for all students from Kindergarten to higher education; excite students about STEM careers; support teachers in improving STEM education; and promote the ISS as a STEM learning platform..

CASIS will work with commercial and academic National Lab users to develop curricula around their payloads in cases where it makes sense for educational purposes. This aspect of our education mission holds great potential for raising awareness about the ISS, supporting teachers, and teaching students about the practical uses of space-based research. This will be an on-going focus for CASIS staff. CASIS will also play a key role in ISS advocacy by developing curricula to excite younger children about Station science in general.

In June, CASIS has signed an agreement with the Student Spaceflight Experiments Program (SSEP), spearheaded by the National Center for Earth and Space Education (NCESSC), to sponsor student science projects on Station. In 2013, SSEP could reach thousands of students and hundreds of communities nationwide. CASIS will work with NCESSC to enhance the program to expand its outreach.

In another example of the innovative, multi-layer deals CASIS can make, the organization this year established a partnership with the PGA of America. By leveraging PGA's immense network of players, professionals, fans and sponsors, CASIS can bring attention and relevance to both Station and the space program by reaching a whole new audience of children, educators, companies, and decision makers. The first prong of this strategic cooperation constituted a pilot PGA STEM Enrichment Camp in June at the PGA Center for Golf and Learning. Over five days, in classroom settings and on a golf course, underprivileged children received instruction in more than just golf; they learned science, math, and engineering and about the ISS and the kinds of research that could take place there. They learned about the physics of golf and how the same principles are used by engineers and astronauts every day. The event was so successful that the PGA is considering rolling out the program nationally, initially expanding the program to 50 sites next year, then to 250 the following year and up to 750 in its third year. This pilot program is model that can be adapted and used by other established organizations to reach the maximum number of students in the shortest period of time.

Other initiatives that CASIS has put into motion with regard to educational endeavors include 'Story Time From Space', in which a well-known science children's author will write a series of books designed to create awareness about Station, which will be read by astronauts in front of video cameras on the ISS NL, exciting young readers about the world in space. ,. The videos will posted on the CASIS website and social media platforms. 'Story Time From Space' will reach a previously underserved demographic and connect literacy with STEM concepts. CASIS is working to finalize this deal by the end of the year.

Operations

The CASIS Operations Director was hired in 2011, and project management staff positions were filled beginning in January of this year. It is completely staffed, with six members. All team members have extensive project management and flight hardware experience from time at space centers, the aerospace industry, and the transportation sector. Operations staff members are responsible for working with their clients from project conception to completion. They will use their knowledge and skills to develop, integrate, and operate projects in order to accomplish the goals of users and to ensure alignment with the CASIS mission.

The operations directorate has assumed responsibility for all National Lab projects and payloads scheduled by NASA for current and future ISS Expedition increments. This includes all research, planning and sponsorship efforts. In particular, CASIS has sponsored research plan updates, assisted with the development of science missions, and assembled the entire ISS NL research plan for September 2013–March 2014, which has been approved by NASA. CASIS Operations is also managing flight opportunities in September 2012–September 2013 for unsolicited projects and the upcoming series of RFPs promoting the utilization of existing ISS facilities in earth observation and microgravity science.

With regards to fulfilling future increments as required by our Cooperative Agreement, we are ahead of schedule. CASIS has identified and developed payloads that will be flown on Increment 37/38, well ahead of the Increment 39/40 timeframe set in our Annual Performance Plan (APP). During Increment 37/38, we are working towards flying 5 to 6 payloads consisting of unsolicited projects that are currently being vetted through our evaluation process. Additionally, we plan to deliver the Windows on Earth software at the end of this year during Increment 35/36. These missions will serve to validate CASIS' processes and capabilities, as required by the APP.

The operations division has also worked with NASA to transition all National Lab projects to CASIS, with the exception of two due to extenuating circumstances. As part of this effort, CASIS adopted the commitments of the existing Space Act Agreements and entered into new Memorandums of Agreement with existing National Lab partners to ensure a continuation of project support and other commitments within CASIS's ability to support.

Under a MOA signed with Bioserve, CASIS has tasked the company with developing a commercial rodent research model in cooperation with NASA Ames and Professor Ted Batemen, a leader in the field of space-based rodent research. Our goal of flying a proof-of-concept mission in the Fall 2013 cuts in half the time it would normally take to develop and deploy such a concept. Along with establishing ground and on-orbit processes, this initiative will include the

demonstration of on-orbit analysis capability, which has never been available to researchers before. Pursuant to this case, we will fly an off-the shelf bone density scanner, which is being hardened for use in space, to develop new means for future osteoporosis research.

The importance of developing a long-term, robust animal research platform cannot be underestimated; it was deemed important by a recent decadal survey as well as the CASIS interim science collegium as key to utilization and maximization of return on investment. The brand new opportunities for research this initiative will provide are essential to developing new business for the National Lab; several pharmaceutical companies have expressed serious interest and a willingness to use the ISS NL, and are eagerly awaiting the successful accomplishment of milestones. This project will also benefit NASA, in that it will be able to utilize this innovative method and hardware for exploration focused research.

Moving forward, this effort will greatly expand the ability of NASA and commercial users to conduct life sciences research in ways that have never been done before. This will enable ISS NL users to move from limited fundamental research to applied research, product development, and ultimately, commercial realization.

Another example of the successful transition of projects from NASA to CASIS is the MOA with NanoRacks. Through this agreement, CASIS has reserved space on the first commercial platform available for researchers outside the ISS in the extreme environments of space. CASIS will be issuing a formal solicitation for proposals to use this one-of-a-kind platform for anything from earth observation to materials research and biological sciences.

This opportunity enables NanoRacks, the provider of sophisticated shoe-box sized space research hardware, to begin design and fabrication of the external platform pallet and be ready for flight in early 2013 – almost a year ahead of schedule. By enabling NanoRacks to extend their "NanoLabs" outside Station, CASIS is helping to bring a whole new generation of researchers to the ISS. The deal also fulfills part of the CASIS mission to enhance capabilities of the ISS NL.

Challenges

As a new organization, CASIS recognizes the inherent obstacles encountered in standing up a new and unique entity. Similar operations typically encounter growing pains. CASIS management must endeavor to maintain independence from NASA, while creating a new way of doing business on the ISS NL. In such circumstances it is not uncommon to see management changes and executive turnover. CASIS was no exception in this regard.

In February, 2012, Dr. Jeanne Becker, the CASIS Executive Director, announced her resignation citing the pressures that she felt at the head of the organization. New management stepped in to get the organization on track and to keep it moving forward. Since Dr. Becker's resignation, CASIS has been developing the initiatives started under Dr. Becker and executing our mandate.

As we have sought to implement the Cooperative Agreement, we have encountered several challenges. As with any engineering project or standup business, there were many issues that Congress, NASA, CASIS and our guiding documents failed to anticipate or address prior to implementation. Given the fact that this concept is brand new and that our mission is to develop and establish innovative ways to promote the ISS NL, challenges were expected.

CASIS is currently working with NASA regarding the handling of Intellectual Property and Data Rights, the resolution of which is essential to securing commitments from commercial users. CASIS continues to work with NASA to find resolutions to these and other critical questions, while understanding our role to establish new pathways and maintain independence from NASA.

How to best capture unsolicited proposals is an area that is continuing to evolve.

Because unsolicited proposals will by their very nature address topics CASIS might not be pursuing through a formal solicitation process, we set out to develop a fair, streamlined process that aligns with overall goals and organizational structure. As with the formal solicitation review process, this method takes into account market realities, resources, and scientific merit. Several unsolicited proposals are currently moving through the pipeline as test cases for CASIS procedures and criteria.

Through significant promotion and outreach efforts, CASIS has and will continue to receive many unsolicited proposals from academic and commercial investigators hoping to utilize the ISS NL. Many have their own funds and are only seeking CASIS' support with transportation, payload integration and/or hardware/experiment design. This unsolicited interest has driven the CASIS Valuation and Prioritization Framework to evolve so that we do not disenfranchise potential users of the ISS NL. History has shown that people have unique and powerful ideas, and CASIS has created a process that will capture, evaluate and prioritize all unsolicited commercial and academic proposals to conduct science on the ISS NL.

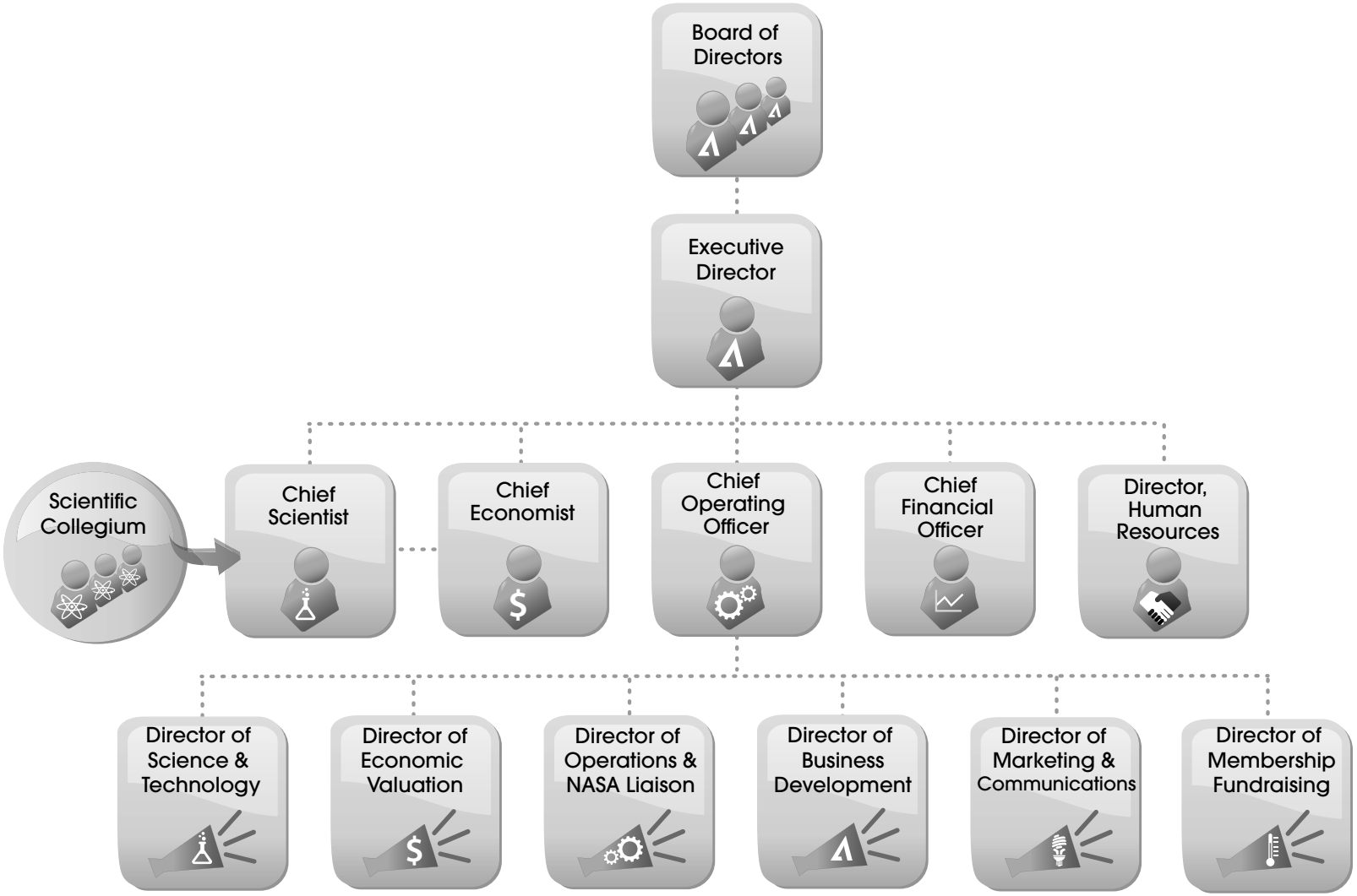
Conclusion

Over the past 11 months, CASIS has seen its share of negative press, in particular, with the resignation of our Executive Director. Since that timeframe however, CASIS has continued to move forward, effectively promoting the ISS NL aggressively and passionately. Through any struggles that might have been perceived, CASIS has continued to meet or surpass-all milestones established for the organization during its first year.

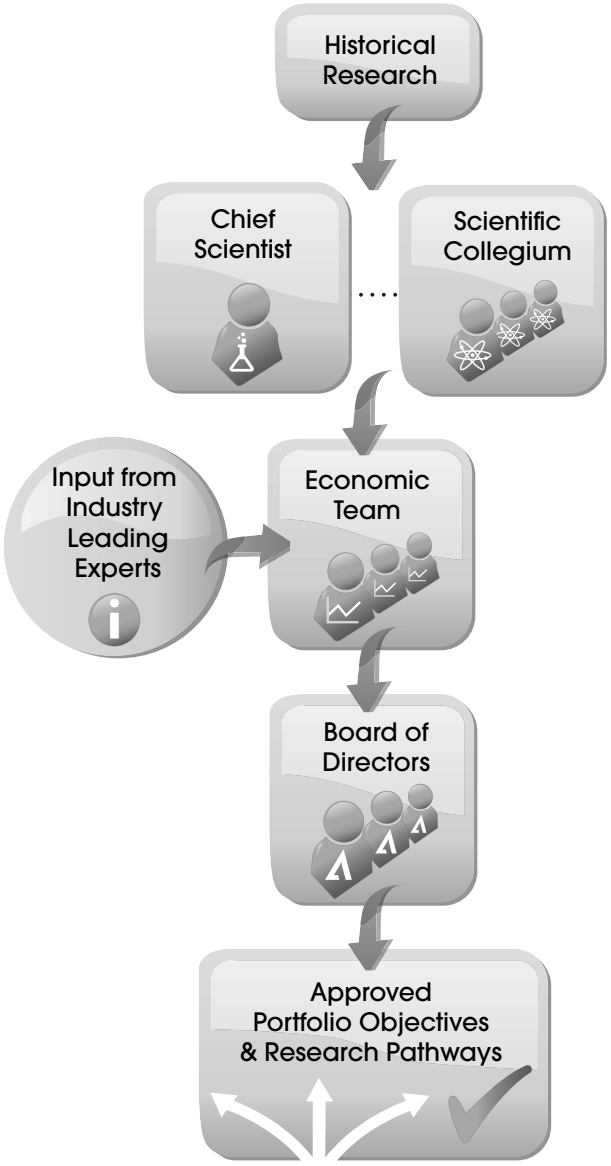
CASIS is now moving from its standup phase to become a fully-operational organization. From our first RFP to announcing partnerships with non-traditional users, CASIS has been making tremendous strides towards maximizing the use of the ISS NL. Our staff continues to engage potential users of Station, developing and evolving our processes which will further identify research opportunities, and with our new Board of Directors nearly in place, the future for CASIS and the ISS NL is unquestionably bright.

The entire CASIS team believes Station is the next emerging market and we plan to promote the world's greatest engineering achievement as a mechanism to create beyond what was previously thought possible. Time is quickly passing, and CASIS will continue to be aggressive in our efforts to bring users on board Station, creating breakthroughs that will benefit humankind

CASIS Organization



CASIS Interim Research Pathway Development Process



1. Develop scientific strategic approach and suggest areas of research (research pathways)
2. Assess market size, market interest and benefit to American taxpayer
3. Chief Scientist and Chief Economist present recommendations to Board based on findings
4. Board reviews and approves strategy
5. Business Development Team focuses on research pathway opportunities

CASIS Interim Research Pathway Valuation Process

1. Director of Operations determined technical feasibility
2. Chief Scientist reviewed for scientific merit and potential impact
3. Chief Economist assessed value to American taxpayer (tangible and intangible)
4. Compliance team assessed legal implications
5. Executive Director reviewed and informed Interim Board for approval

CASIS Valuation and Prioritization Framework

Proposals to utilize the ISS National Lab ("NL") fall into two categories: **Solicited and Unsolicited.** Solicited proposals are responses to CASIS RFP releases driven by portfolio objectives and research pathways approved by the CASIS Board of Directors ("BOD"). Unsolicited proposals are a result of promotion of the ISS NL and focused CASIS outreach led by the CASIS Business Development ("BD") team. These outreach efforts allow both academic and commercial investigators to realize that CASIS can facilitate access to the microgravity environment provided by the ISS NL.

Solicited Proposal Valuation and Prioritization Process:

1. Chief Scientist ("CS") and the Science Collegium ("SC") will first develop overall portfolio objectives (basic research vs. applied research) and suggest research pathways (biosciences vs. materials science vs. earth observation, etc.). The SC will consist of various academic and commercial experts in their respective fields.

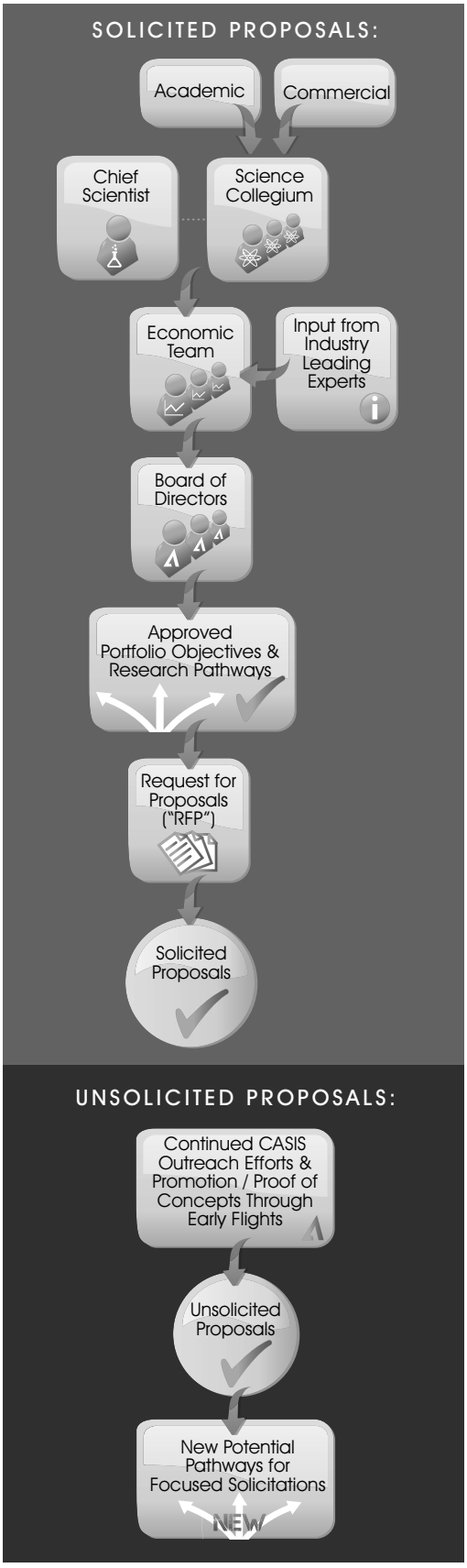
2. The CASIS Economic team reviews the portfolio objectives and research pathways identified by the CS and SC. The Economic team may utilize relationships with industry-leading external consultants depending on the industry (e.g. McKinsey & Co., Bain & Co., Boston Consulting Group, etc.) to recommend changes to the portfolio objectives and/or research pathways if appropriate. Some key areas of consideration include (i) market size, (ii) time to translation of benefits to American taxpayers, (iii) potential customer feedback, and (iv) scientific merit as determined by the SC.

3. Chief Economist ("CE") and CS sign off on research pathways and portfolio objectives. It is the responsibility of the CE and CS to present research and portfolio objectives to the CASIS Board of Directors ("BOD"). The BOD will then either approve or disapprove these objectives and pathways. In addition, the BOD may suggest changes to render pathways consistent with the CASIS mission.

4. Upon BOD approval, execution takes place through the CASIS Business Development ("BD") team. BD develops a tactical execution plan for each defined vertical market segment, using the Board members as well as the economic team, scientific team, communications team, and external consultants to help stimulate demand. The execution plan may include attending industry conferences, communicating directly to industry associations, potential commercial customers and key researchers in a given field, and releasing focused solicitations.

CASIS will use funds to:

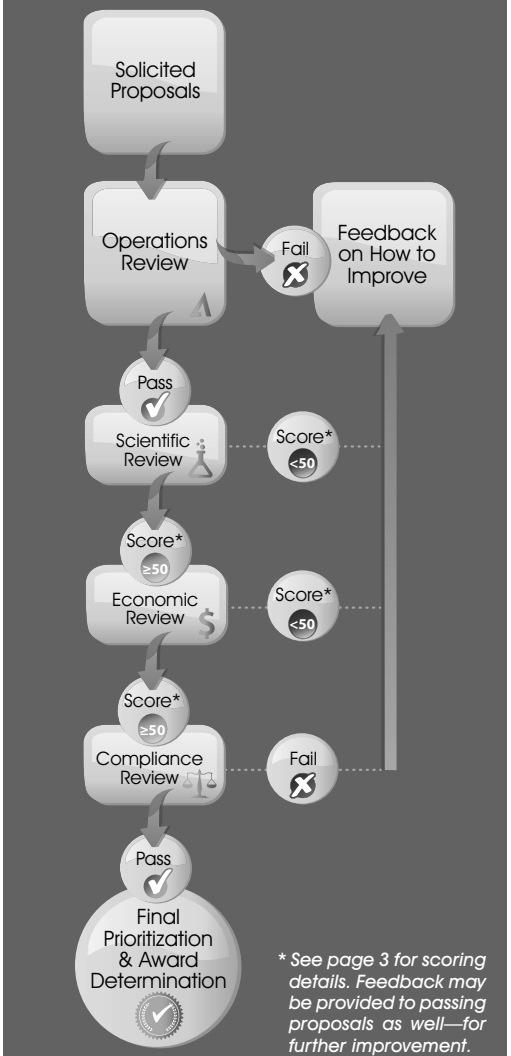
- (i) offer grants through solicitations,
- (ii) match investigator funding and
- (iii) create enhancements to current ISS NL capacity and ground capabilities.



5. After receiving proposals that aim to achieve the established portfolio objectives and research pathways, CASIS will utilize a valuation and prioritization framework for grading each individual proposal. The valuation and prioritization process for solicited proposals will include five steps:

- **a.** Expedited review by the CASIS Operations team to determine technical feasibility of the proposed project and the achievability of the estimated budget and timeline
- **b.** Evaluation by the Scientific Project Selection Panel ("PSP"), an external panel of subject matter experts, to score the proposal for scientific merit and potential commercial/social impact
- **c.** A two-pronged economic evaluation process by the Economic PSP, managed by the CASIS economic team, to score potential commercial and intangible value
- **d.** Review by the CASIS Compliance team of regulatory and legal risks
- **e.** A final prioritization and award determination by the CASIS Executive Director ("ED"), CE and CS on the basis of recommendations from the PSPs and CASIS staff, as appropriate

SOLICITED PROPOSAL EVALUATION & PRIORITIZATION:



** See page 3 for scoring details. Feedback may be provided to passing proposals as well—for further improvement.*

Further details on each step of the process are:

OPERATIONS: Technical feasibility of proposals is performed to ensure the viability and readiness for flight. The review is performed by the CASIS Operations team, which will consult as needed with NASA and outside technical experts to determine overall feasibility. This review is an unscored, pass–fail initial screening; however, CASIS may consider an interview with the investigator(s) to clarify technical elements of the proposal as well as the proposed budget and schedule in order to make its determination. Specifically, the technical feasibility review considers the following elements:

Logistics: Proposed resources including implementation partner support, facility needs for ground testing and flight operations support, use of ISS crew for research support, power and data requirements, weight and any known hazards

Hardware: Availability, limitations, appropriate planned use, alternatively the costs and feasibility of proposed new hardware development

Projected Budget and Timeframe: Preflight development and testing considerations, time to flight and time to completion

Hazards: Procedures, situations and materials that could potentially be hazardous and a plan to mitigate any identified issues

Questions: Follow-up questions for the investigator(s), including as appropriate—

- Revised methods/analyses, and how results will be collected, analyzed and interpreted
- Awareness of potential barriers and ideas about alternative approaches

The Operations team will organize its comments into an Operations Appendix to the proposal. The Appendix will provide crucial input for prioritization (e.g., time frame and budget) and will identify logistical challenges in the proposals in areas where new-to-space investigators will potentially be deficient. This function serves to support the new space investigator so that appropriate considerations are made in their proposals, as well as to prevent experienced space investigators from scoring higher in the later rounds of review (thereby supporting the CASIS goal to attract new users).

Only proposals that demonstrate operational feasibility will pass this round of review and advance to scientific evaluation. The decision of the Operations review is final and not subject to appeal.

SCIENTIFIC EVALUATION: Using the scoring rubric below, an external panel of subject matter experts in the RFP target field, assembled by CASIS, will evaluate proposals which passed the Operations review. Their evaluation will consider both the original proposal and any additional information provided in the Operations Appendix.

SCORE	DESCRIPTIVE FEATURES	POTENTIAL FOR SELECTION
90–100	**EXCELLENT:** A thorough, comprehensive and compelling proposal of exceptional merit that fully responds to the objectives of the RFP, as documented by several major strengths; no major weaknesses and only very minor weaknesses, if any.	Top priority for selection.
80–89	**VERY GOOD:** A competent proposal of high merit that fully responds to the objectives of the RFP, as documented by one or more major strengths and no major weaknesses; strengths substantially outweigh any minor weaknesses.	Second priority for selection, barring issues of funding availability or programmatic priorities.
70–79	**GOOD:** A competent proposal that represents a credible response to the RFP, as documented by no major weaknesses; strengths and weaknesses on the whole are in balance, but strengths somewhat outweigh weaknesses.	May be selected as funds permit according to programmatic priorities.
50–69	**FAIR:** A proposal that nominally responds to the RFP, in which one or more major weaknesses, in combination with any minor weaknesses, clearly outbalance any strengths.	May be selected after revisions as funds permit according to programmatic priorities.
0–49	**POOR**: A proposal with several major weaknesses or weaknesses that constitute fatal flaws.	Not selectable regardless of programmatic priorities or availability of funds.

Minor weakness: an easily addressable weakness that does not substantially lessen merit/impact.
Major weakness: a weakness that severely limits merit/impact.

0-49	50-69	70-79	80-89	90–100

- **FAIL**
- **PASS**

Reviewers will score the following categories on a 0-100 scale and will average individual scores to produce an overall merit/impact score:

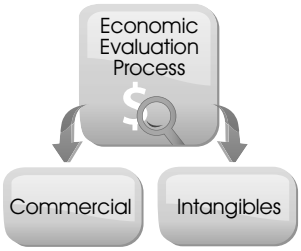
- **Significance** - DESCRIPTORS/CRITERIA: If successful, the results will have rapid scientific, commercial and humanitarian impact and significant scientific, commercial and humanitarian potential. The results could yield a new line of space research with strong scientific, commercial and humanitarian potential or build on prior successful research produced on the International Space Station. If successful, the results will advance the leading edge of the field. Negative results will have significant impact within the research area. If successful, the results will influence broad fields of study. The research builds on a foundation of existing space or ground research to bring the pathway closer to commercial application.

- **Investigators** - DESCRIPTORS/CRITERIA: The investigator(s) has the financial stability to complete a project. The investigator(s) has documented success in the field of study (as demonstrated by strong publication record, commercial success, patents or technology implementation resulting from R&D). The investigator(s) has a strong publication record or demonstrated success in R&D (as measured by commercial success, patents or technology implementation resulting from scientific research). If the applicant is a new investigator(s), or one in the early stages of an independent career, the investigator(s) has appropriate experience and training or has partnered with a qualified coinvestigator. If the project is collaborative (e.g., multiple institutions or coinvestigators), the investigators have complementary and integrated expertise; their leadership approach, governance and organizational structure are appropriate for the project.

- **Innovation** - DESCRIPTORS/CRITERIA: The project is innovative with respect to multidisciplinary integration and novelty of topic or approach. The project's results, if successful, will challenge current research or commercial practice paradigms. The project's concepts, approaches, instrumentation or interventions are new to more than one field of research. The project improves or suggests a new application of theoretical concepts or approaches.

- **Approach** - DESCRIPTORS/CRITERIA: The scientific merit of the proposal is sound. The proposed project fits the CASIS mission, satisfying the overall objective of the RFP and both the short- and long-term objectives of CASIS. The proposal explains the hypotheses or the required elements of the proposed technology demonstration, including well-defined ground controls. The project requires the space environment for advancement with respect to time and/or capability. The project's potential problems, alternative strategies and benchmarks for success are presented (may refer to Operations Appendix).

- **Environment** - DESCRIPTORS/CRITERIA: The investigator(s) has access to crucial ground technology and experience necessary for preflight work and ground controls. The proposal contains compelling and well-developed preliminary work. The project will benefit from the space environment. The investigator(s) has demonstrated understanding of how data collection, analysis and interpretation must be approached on the basis of the unique conditions of the space environment (may refer to Operations Appendix).



ECONOMIC EVALUATION: The Economic Evaluation process will be twofold, with each branch of the process (Commercial and Intangibles) using a 0–100 scale and the same scoring rubric as the Scientific Evaluation process. The weighting of the intangible score in the final combined score will range from 0 to 50%, depending on what part of the research pathway the proposal affects (higher weighting for affecting later points in the pathway closer to commercial product application).

Similar to the Scientific Evaluation process, CASIS will assemble an external panel of subject matter experts to evaluate the proposals. These experts will most likely come from industry-leading consulting firms including McKinsey & Co., Bain & Co., Boston Consulting Group, etc.

Reviewers will evaluate commercial letters of support during this stage, which may impact multiple scoring categories.

COMMERCIAL EVALUATION:

Reviewers will score the following categories:

- **Management and Key Employees** - DESCRIPTORS/CRITERIA: The current management team is qualified to and can execute the project. The team has prior successful experience working together. The team or PI has prior experience in similar capacities (however, cannot fault for lack of space experience) and has demonstrated high likelihood of future success in the field of interest. The project lists necessary, relevant and qualified key collaborators.
- **Market(s) and Competition** - DESCRIPTORS/CRITERIA: The current size and forecast growth rate of the relevant market(s) is noted and addressed, and these data support potential market impact of successful results. The proposal addresses both barriers to entry and market competition. The team can either commercialize products or partner with companies with established commercial success. A customer base exists for potential products (i.e., new innovation vs. advancing something existing or solving a problem).
- **Products/Services and Technologies** - DESCRIPTORS/CRITERIA: The products/services/key technologies that will benefit from successful results are clearly defined, feasible and unique. The resulting product/service will provide specific and significant benefits to the U.S. economy or population. Customers will easily understand the benefits/products resulting from successful results. Product/service development plan, timing and costs are feasible and realistic. Technology risk assessment, if applicable, has been performed and/or is not likely to pose a problem. Patents, trade secrets or copyright protection, if available for the products/technologies/services, will increase likelihood of market impact and commercial success.
- **Business and Operating Plan** - DESCRIPTORS/CRITERIA: The proposal coherently states project mission, strategy and implementation. The competitive environment and CASIS objectives are clearly understood. Required resources (e.g., human, capital) are described and understood. The description of commercial application is adequate, and the forecast results are reasonable. Contingency plans are in place and reasonable.
- **Customers and Suppliers** - DESCRIPTORS/CRITERIA: Customer opinion about the field/market/competition is favorable to market entry and success. Key suppliers are stable and reliable/high quality. Single-source components or technologies are unlikely or are acceptable where applicable. Investigators are aware of companies interested in commercializing the product(s) resulting from the research.

INTANGIBLES EVALUATION:

Reviewers will evaluate three key categories:

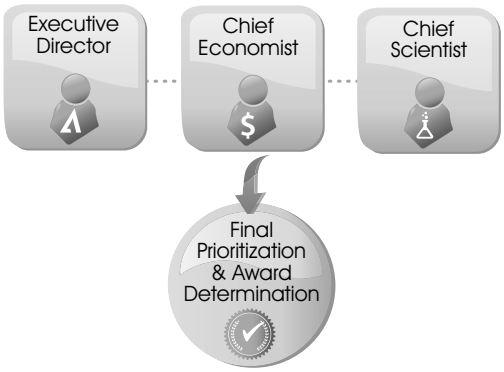
- **Greater Good to Society** - DESCRIPTORS/CRITERIA: The overall potential for impact on the U.S. society is of significant value. The project advances discovery and understanding while promoting teaching, training and learning. The proposed project broadens the participation of underrepresented groups. The project increases throughput of the supply chain—innovations affecting humans, animals, plants, climate and resources now or in the future (e.g., fewer deaths, fewer sicknesses, healthier livestock, a more abundant food supply, the protection of endangered plant or animal species, reduced pollution, improved ground energy efficiency). Project success will beget future projects of intangible or tangible value. The project addresses an important problem or a critical barrier to progress in the field.

- **U.S. Leadership in Space** - DESCRIPTORS/CRITERIA: The success of the project will change the concepts, methods, technologies, treatments, services or interventions that drive the relevant field. Potential exists for significant international impact. The project advances the CASIS mission to balance a diverse portfolio of research disciplines and stages. The project enhances awareness among potential International Space Station constituency groups regarding the advantages of performing science in space (i.e., it will promote interest in using the National Lab). The project shows how space station technology contributes to products and services revenue and related tax revenue from profits (i.e., it demonstrates value to the public).

- **Economic and Human Capital Development** - DESCRIPTORS/CRITERIA: The benefits of the proposed project to society include job and wealth creation, as well as improved quality of life, knowledge, skill sets and sustainability. The project bridges basic science with industrial R&D applications. Project success will enhance the infrastructure for space-based research and education (e.g., facilities, instrumentation, networks and partnerships). The results will be disseminated broadly to enhance scientific and technological understanding, enabling developments in science by allowing researchers to build on each other's work and providing content for educational curricula.

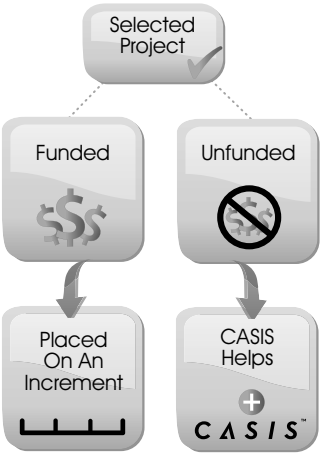
REGULATORY REVIEW: After the economic evaluation, the CASIS Compliance team will review meritorious projects, providing notes regarding potential problems for the following areas: data integrity, risk liability, ethics and research integrity, regulatory compliance and conflicts of interest.

PRIORITIZATION AND AWARD DETERMINATION: The ED, CE and CS will perform the final prioritization and award determination, initiating discussions with members of the Project Selection Panels and CASIS management-level staff as necessary.



The ED, CE and CS will meet and review the eligible projects, relative to the entire NL research portfolio, on the basis of scientific merit, scientific value, economic value, technology advancement and educational value. They will consider estimated cost and timeline alongside scores and comments from all review steps.

The ED, CE and CS will analyze the Operations Appendix to proposals to ensure sufficient facility capacity and on-board resources in the given increment. Based on the facility and resource requirements known at the time of prioritization, they will categorize and organize payloads accordingly, consulting CASIS Operations staff as necessary for clarification. If all eligible projects fall within the available CASIS resources and facility capacity, then prioritization, for this purpose, would not be necessary. If unforeseen changes to available resources occur, CASIS will reprioritize the payloads.



All projects must meet minimum eligibility requirements such as readiness for an increment, secured funding (including CASIS grant funding) and an agreement with an implementation partner. Prioritized proposals with sufficient funding will advance to the CASIS Operations team for preflight activity and project management. CASIS Operations staff will participate in NASA research processes to support established strategic and tactical planning.

For projects without sufficient funding to advance to Operations, CASIS will assist with finding potential funding sources including reaching out to the investor community.

Lower priority proposers will be notified that their project needs improvement with feedback on its weaknesses, and they will be invited to re-submit at a later date and/or post an advertisement seeking financial or research support on the CASIS Innovative Marketplace Exchange Forum.

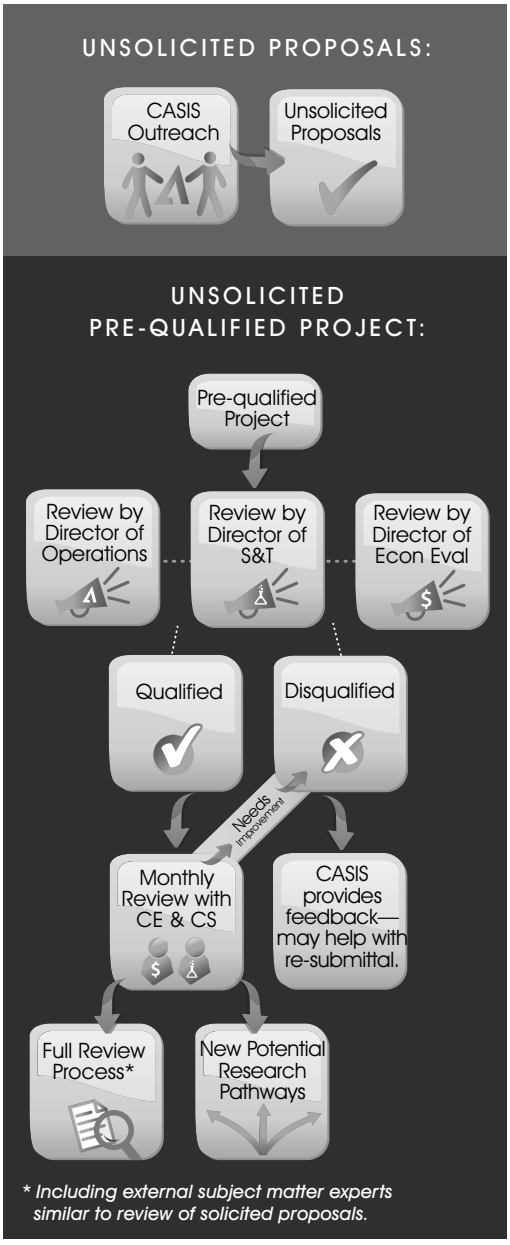
Unsolicited Proposal Valuation and Prioritization Process

Through promotion of the research opportunities available on the ISS NL, CASIS has and will continue to receive many unsolicited proposals from investigators hoping to utilize the ISS NL and are asking what it would take to get there. This unsolicited interest has caused the CASIS approach to evolve so that we do not disenfranchise potential users of the station. History has shown that people have unique and powerful ideas, and

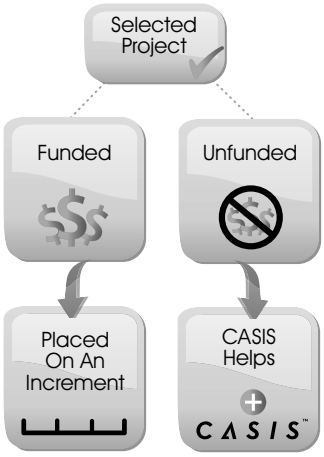
> CASIS has created a process that will capture, evaluate and prioritize all unsolicited commercial and academic proposals to conduct science on the ISS NL.

Upon receipt, all unsolicited proposals or leads will be forwarded to the Business Development ("BD") team. If a full proposal is delivered to CASIS (rather than a verbal description), the proposal will then be logged into the CASIS database as a "pre-qualified" project. The BD team will alert the Director of Operations, Director of Science and Technology, and Director of Economic Evaluation of all new projects that require a review for qualification. Upon notice, the respective directors and their teams will, in parallel, evaluate each proposal to see if (a) it has potential to fly and warrants further investigation or (b) it has obvious deficiencies and does not warrant further investigation. For those that are disqualified, feedback is provided to proposers on potential enhancements that might improve their chances of moving forward.

All qualified unsolicited opportunities will be discussed in a monthly review with the CS and CE. During this monthly review, the CS and CE will receive a flash report of qualified proposals, and each project's details and merits will be discussed. The CS and CE will provide feedback on specific projects. Additionally during this monthly review, the CS and CE may identify and develop new research pathway opportunities for BOD consideration.



Specific projects the CS and CE identify as qualified opportunities fall into the same review process as proposals that are submitted through traditional solicitations, including (i) an Operations Evaluation, (ii) Scientific Evaluation with external review panel, (iii) Economic Evaluation with external review panel, and (iv) the final selection panel consisting of the ED, CS, and CE.



All unsolicited projects must meet minimum eligibility requirements such as (i) readiness for an increment, (ii) secured funding (including CASIS grant funding), and (iii) an agreement with an implementation partner. Prioritized proposals with sufficient funding will advance to the CASIS Operations team for preflight activity and project management. CASIS Operations staff will participate in NASA research processes to support established strategic and tactical planning.

For qualified projects that lack the necessary funding for advancement, CASIS will assist in creating relationships with the investor community for potential financial partnerships.

Lower priority proposers will be notified that their project needs improvement with specific feedback on weaknesses, and they will be invited to re-submit at a later date and/or post an ad on the CASIS innovative marketplace exchange forum.